Walter Simson, PhD

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EXPERIENCE

RESEARCH SCIENTIST | STANFORD UNIVERSITY
June 2022 – Present | Palo Alto, USA

- Conduct and manage research on **deep learning** for **sound speed estimation** in medical ultrasound.
- Adapt and contribute to numerical simulations of the wave equation in **CUDA**, **PyTorch** and **JAX**.
- Explore the application of novel machine learning approaches to the inverse problem in sound speed estimation.

RESEARCH ASSISTANT | TECHNICAL UNIVERSITY OF MUNICH
August 2017 – April 2022 | Munich, Germany

- Worked on **sound speed estimation**, segmentation, classification, data augmentation, surgical workflow analysis, domain adaptation, and reinforcement learning for robotic ultrasound projects with **11 publications**.
- Conducted both **simulation and human participant studies** for medical deep learning applications with **IRB approval**.
- **Managed** research teams in an interdisciplinary research lab.
- **Supervised** over 15 undergraduate and graduate students.
- Published open source code for **deep learning** in ultrasound research including **k-wave-Python** and **UFF.py**

TECHNICAL CONSULTANT | ALEXANDER THAMM GMBH
May 2014 – May 2015 | Munich, Germany

- Created **cloud-based** proof-of-concept projects with **Python** for e.g. **Volkswagen Group**, **BMW** and **MapR**.

EDUCATION

TECHNICAL UNIVERSITY OF MUNICH | PHD,
COMPUTER AIDED MEDICAL PROCEDURES (CAMP)
July 2017 - September 2022 | Munich, Germany

- Dissertation: "Physics-Informed Deep Learning for Advanced Medical Ultrasound"

TECHNICAL UNIVERSITY OF MUNICH | MASTER OF SCIENCE,
COMPUTATIONAL SCIENCE AND ENGINEERING
April 2014 - June 2017 | Munich, Germany

- Thesis: "A practical approach to Walking on Spheres with GPUs"
- Course work in numerical programming, computer science, scientific computing and high performance computing.

TECHNICAL UNIVERSITY OF MUNICH | BACHELOR OF SCIENCE,
MECHATRONICS (ELECTRO-MECHANICAL ENGINEERING)
September 2010 - April 2014 | Munich, Germany

LANGUAGES AND COMPUTER SKILLS

LANGUAGES

NATIVE :
English, German
ADVANCED :
Python, MATLAB, Bash
INTERMEDIATE :
Julia, C++

SOFTWARE

LIBRARIES AND PACKAGES
PyTorch • PyTorchLightning • Numpy
k-Wave • CUDA • OpenMPI • OpenMP
TOOLS
Linux • Docker • profiling • *vim* • tmux • Kubernetes
Polyaxon • PyCharm • CLion • CMake

TEACHING

BASIC MATH TOOLS | 2018 | 2019
- The course is covering topics ranging from linear algebra, analysis, and optimization to probability theory.

COMPUTER AIDED MEDICAL PROCEDURES: CAMP I | 2017 | 2018
- Held lectures on advanced ultrasound imaging for computer science students.

PROJECTS

K-WAVE-PYTHON | Open-Source Project
Wave simulation interface in Python | https://github.com/waltsims/k-wave-python

ULTRASOUND FILE FORMAT (UFF) | Open-Source Project
Python reader for ultrasound channel data file format | https://github.com/waltsims/uff.py

TURBULENCE | Lab Project
Team member in January 2016 | https://github.com/martenlienen/turbulence

GPU ACCELERATED RANDOM WALK ON SPHERES | Masters Thesis
May 2016 | https://github.com/waltsims/WoS.cu

FUNDING

BACATEC: AI-DRIVEN ROBOTIC MOLECULAR IMAGING Funding Number: 8 [2023-1]
May 2023 | 9,000€
- Proposed and received scientific exchange funding between the Technical University of Munich and Stanford University.

ZENTRALE INNOVATIONSPROGRAMM MITTELSTAND Funding Number: ZF4190502CR8
September 2018 | 190,000€
- Proposed and received PhD funding with Prof. Navab for a research project on inverse problems in ultrasound imaging.

NVIDIA GPU GRANT
Spring 2017, 2018 | 2 x 1,299€

PATENTS

US APPLICATION NR. 63/535555 Priority 2023 | Filed
Adaptive Acoustic Imaging with Differentiable Beamforming

US20210132223A1 Priority 2018 | Pending
Method and Apparatus for Ultrasound Imaging with Improved Beamforming

PUBLICATIONS

- **Walter Simson**, Louise Zhuang, Sergio Sanabria, Jeremy Dahl, and Dongwoon Hyun. Differentiable beamforming for ultrasound autofocusing. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*. Springer, 2023

- Yordanka Velikova, Mohammad Farid Azampour, **Simson, Walter**, Vanessa Gonzalez Duque, and Nassir Navab. Lotus: Learning to optimize task-based us representations. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*. Springer, 2023

- Francesca De Benetti, **Simson, Walter**, Magdalini Paschali, Hasan Sari, Axel Romiger, Kuangyu Shi, Nassir Navab, and Thomas Wendler. Self-supervised learning for physiologically-based pharmacokinetic modeling in dynamic pet. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*. Springer, 2023

- Dominik Jüstel, Hedwig Irl, Florian Hinterwimmer, Christoph Dehner, **Simson, Walter**, Nassir Navab, Gerhard Schneider, and Vasilis Ntziachristos. Spotlight on nerves: Portable multispectral optoacoustic imaging of peripheral nerve vascularization and morphology. *Advanced Science*, page 2301322, 2023

- Rehman Ali, Thurston Brevett, Louise Zhuang, Hanna Bendjador, Anthony S Podkowa, Scott S Hsieh, **Simson, Walter**, Sergio J Sanabria, Carl D Herickhoff, and Jeremy J Dahl. Aberration correction in diagnostic ultrasound: A review of the prior field and current directions. *Zeitschrift für Medizinische Physik*, 2023

- Dongwoon Hyun, Leandra Brickson, Louise Zhuang, **Simson, Walter A**, Gianmarco Pinton, and Jeremy Dahl. Applications of ultrasound image reconstruction using deep learning. *The Journal of the Acoustical Society of America*, 152(4):A113–A113, 2022

- **Walter Simson**, Magdalini Paschali, Vasiliki Sideri-Lampretsa, Nassir Navab, and Jeremy Dahl. *Investigating Pulse-Echo Sound Speed Estimation in Breast Ultrasound with Deep Learning. Under Review*, 2022

- Viviana Sutedjo, Maria Tirindelli, Christine Eilers, **Walter Simson**, Benjamin Busam, and Nassir Navab. *Acoustic Shadowing-Aware Robotic Ultrasound: lighting up the dark. IEEE Robotics and Automation Letters*, 2022

- Maria Tirindelli, Christine Eilers, **Walter Simson**, Magdalini Paschali, Mohammad Farid Azampour, and Nassir Navab. Rethinking ultrasound augmentation: A physics-inspired approach. In *International Conference on Medical Image Computing and Computer-Assisted Intervention*, pages 690–700. Springer, 2021

- Tobias Czempiel, Magdalini Paschali, Matthias Keicher, **Walter Simson**, Hubertus Feussner, Seong Tae Kim, and Nassir Navab. *TeCNO: Surgical Phase Recognition with Multi-Stage Temporal Convolutional Networks. e International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, 2020

- Hannes Hase, Mohammad Farid Azampour, Maria Tirindelli, Magdalini Paschali, **Walter Simson**, Emad Fatemizadeh, and Nassir Navab. *Ultrasound-Guided Robotic Navigation with Deep Reinforcement Learning. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020

- Zhongliang Jiang, Matthias Grimm, Mingchuan Zhou, Javier Esteban, **Walter Simson**, Guillaumel Zahnd, and Nassir. Navab. *Automatic Normal Positioning of Robotic Ultrasound Probe based only on Confidence Map Optimization and Force Measurement. IEEE Robotics and Automation Letters*, 2020

- Magdalini Paschali, **Walter Simson**, Abhijit Guha Roy, Rüdiger Göbl, Christian Wachinger, and Nassir Navab. *Manifold Exploring Data Augmentation with Geometric Transformations for Increased Performance and Robustness.* In *International Conference on Information Processing in Medical Imaging (IPMI)*, pages 517–529. Springer, 2019

- **Walter Simson**, Rüdiger Göbl, Magdalini Paschali, Markus Krönke, Klemens Scheidhauer, Wolfgang Weber, and Nassir Navab. *End-to-End Learning-Based Ultrasound Reconstruction. arXiv preprint arXiv:1904.04696*, 2019

- Magdalini Paschali, Muhammad Ferjad Naeem, **Walter Simson**, Katja Steiger, Martin Mollenhauer, and Nassir Navab. *Deep Learning Under the Microscope: Improving the Interpretability of Medical Imaging Neural Networks. arXiv preprint arXiv:1904.03127*, 2019

- Javier Esteban, **Walter Simson**, Sebastian Requena Witzig, Anna Rienmüller, Salvatore Virga, Benjamin Frisch, Oliver Zettinig, Drazen Sakara, Yu-Mi Ryang, Nassir Navab, et al. *Robotic ultrasound-guided facet joint insertion. International journal of computer assisted radiology and surgery*, 13(6):895–904, 2018

- **Walter Simson**, Magdalini Paschali, Nassir Navab, and Guillaume Zahnd. *Deep learning beamforming for sub-sampled ultrasound data.* In *2018 IEEE International Ultrasonics Symposium (IUS)*, pages 1–4. IEEE, 2018